AGRICULTURAL Research

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Preservation partnership

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JOSEPH F. SILBAUGH—MANAGING EDITOR

NO MISTAKE

Can farmers afford to make mistakes? One look at the high investment cost and high cash outlay of modern farming gives you the answer.

A farm takes an average investment of perhaps $20,000 for each worker. That's more than twice as much as many industries invest.

And farmers are more dependent than ever on manufactured items—machinery, gasoline, oil, fertilizers, building materials. With higher prices and greater use, these may run three times as much as in 1941.

Such costs don't leave much room for management errors. Farmers can't afford the risks. Farming is hazardous enough without them.

What farmers need nowadays is scientifically sound facts—*related* facts—in making crop and livestock production plans and in using their soil, equipment, and labor to best advantage.

A modern farmer is called on to be an expert technician in all sorts of fields. He has to be economist enough to know when to buy and when to sell. He has to be engineer enough to run thousands of dollars' worth of machinery, mechanic enough to repair it when it breaks down. He must dip into veterinary medicine, entomology, and agronomy.

Many of these jobs call for delicate operations and decisions that often have an important bearing on other operations and decisions. The various elements in the management of a farm must fit together properly if the farm is to be a smooth-running, profitable business. It's clear that a patchwork approach in adopting recommendations just won't do.

But many farmers are bound to hit difficulties in fitting the available improvements into a farm-management pattern that pays them a profit and fits into the agricultural needs of the Nation.

Research has a responsibility to help overcome such difficulties. We can't assume that giving a farmer all the information in the world on a particular dairy, livestock, or crop problem—without weighing a lot of other matters, too—will be any help to him.

We need a *whole-farm* approach. And that calls for whole-farm planning of our agricultural research and our farm advisory service.

No, farmers can't afford faulty planning. Neither can the Nation. Our swelling population demands more food and fiber. This must come largely through efficiency, especially sound farm management.

AGRICULTURAL RESEARCH SERVICE
United States Department of Agriculture

ROTARY DRIER developed by ARS engineers is a key piece of equipment in the promising food-preservation process of dehydrofreezing. It combines drying and freezing (story p. 4).

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Livestock for released acres

CROP CUTBACKS CALL FOR FARMING SHIFTS

ROP CUTBACKS may turn many farmers to growing forage and ther feeds to use acreage released rom cash crops under the production ontrol program. Eventually this ill mean more livestock. The shift ay be a good move for farmers.

USDA economist R. P. Christensen oints out that fixed resources—nd, buildings, family labor, and achinery—must either be used or lled. Most farmers need to use these esources fully to meet their high xed expenses for taxes, interest, and ayments on land and machinery. nd to produce profitably, farmers ust take advantage of such modern onfarm items as fertilizers, pesti-des, and laborsaving equipment.

Christensen thinks the price pros-ects are better for livestock products, uits, and vegetables than for some sh crops. Of course, growing fruits d vegetables isn't practical in the ain wheat and cotton areas. But he els that some shift to livestock would e desirable in many areas—might be astened, in fact, by production con-ols on leading cash crops—and ould help balance the farm economy d give better returns than might herwise prevail. There are several asons for thinking this.

First, population is growing and ill raise total consumption 6 or 7 ercent by 1960. That calls for adual expansion in farm output.

Another important point is that e time lag in disposing of crops rough livestock would hold down arketings for 2 or 3 years from what ey otherwise would be. Increasing erds and flocks would keep that much feed off the market and also use up much feed now on hand. Christensen points out, however, that this time lag has a disadvantage—it reduces farm income while expenses are raised in making the new start.

Also, the demand for red meats, poultry meats, eggs, and fluid milk is more elastic than for most other farm products. Ordinarily, consumers do not use as much of these items as they would like—will consume relatively more if there's a rise in buying power or a drop in price.

The demand situation is different with many cash crops. Large carry-over stocks of wheat, corn, cotton, and some other farm products have been accumulated in the last few years. Production of these commodities has exceeded market takings.

There's a fairly narrow and well-defined range between the smallest supply of these commodities that consumers can get along with and the largest amount they will consume without special inducement. So supply changes cause disproportionate price changes. Cutting supply through production curbs and use-up of stocks should have price-lifting effects and compensate some for reduced income.

Christensen thinks balancing production with consumption in 1960 will call for increases of 6 or 7 percent over the 1954 production levels in several lines—red meats, eggs, poultry, and feed crops—and a little more for fruits and vegetables. He also believes such changes wouldn't alter the national diet much for a year or so. Time lags in marketing would prevent it. But the changed production would then begin enriching the diet with optional foods and increasing the total of production by 1 or 2 percent yearly.

Christensen believes that in order to make those shifts, some change will be needed in the kinds and amounts of resources put into production. It means putting more capital into livestock, buildings, equipment, and improved pastures, and more land into feed grains and hay. Displaced cash-crop acreage will supply a large part of the additional feed needed. Some of the released equipment and goods could be used to improve pastures and to produce other feeds.

Though the Nation's choice may seem clear, the choice isn't so simple for farmers. Not all of them can or should do what collectively seems desirable. Many factors govern a farmer's decision—the size, kind, and location of his farm, the combination of enterprises on it, attained efficiency, his debt and credit situation, and many other factors.

Many farmers will wish guidance in planning for the future—not only how to use their land wisely, but also what kind of capital improvements to make, what to do about short-term, intermediate, and long-term borrowing, and how to reduce costs. These problems aren't well understood now and should get more study.

Hopes are that enough farmers will find both opportunity and advantage in shifting production from some surplus crops to livestock at the proper time, so that national balance will be restored in agriculture. Then all farmers will gain.☆

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IT SAVES SPACE, WEIGHT, MONEY, AND FLAVOR

It's a comer: dehydrofreezing

SCIENTISTS have combined the space and weight economies of dehydration with the convenience and freshness retention of freezing to give us a new food-preservation process called dehydrofreezing.

It's now in commercial use by six firms, with more showing interest.

The USDA Western Regional Research Laboratory, Albany, Calif., developed this process, available for public use through a patent issued to the Secretary of Agriculture.

Some of dehydrofreezing's advantages have already been mentioned. There's still another: a more natural product. Dehydrofrozen apples, for example, have a much firmer texture when thawed and make better pies than apples frozen in the regular way.

Ordinary freezing, you see, tends to rupture cellular structure. That's why many fruits and vegetables break down somewhat after freezing and thawing. But cells that have been partially dehydrated aren't ruptured so easily by the freezing process.

Dehydrofrozen foods retain just enough moisture—the optimum point of dehydration is approximately half of original weight and volume—to hold their quality as well as foods that haven't been dehydrated at all. And temperatures don't rise high enough in the dehydration step to bring about the flavor changes characteristic of ordinary dried foods.

Reconstitution of dehydrofrozen products is simple. They can be cooked directly or soaked in water.

Essentially, the dehydrofreezing process consists of (1) conventional preparation of the commodity as for regular canning or freezing; (2) inactivation of enzymes, when necessary, to prevent browning; (3) rapid drying to reduce weight and volume by at least half; (4) packaging and freezing; (5) storage at 0° F.

Various types of drying equipment can be used, depending on the product. For instance, commercial prune-drying equipment has proved suitable for halved apricots, which take 3 to 4 hours for dehydration. Apple slices and pimientos, on the other hand, can be dried adequately in 1 hour or less. Continuous drying equipment dehydrates such products more uniformly and cuts labor costs.

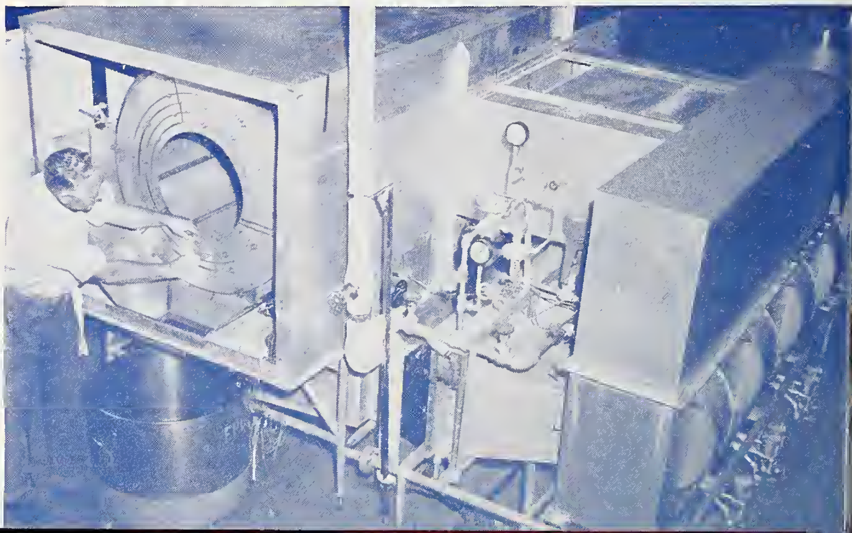
A continuous rotary drier has been devised by ARS engineers at the Western Laboratory (see picture). This drier delivers air through the bed of food material by four separate ducts, each with a blower and steam coils. The tendency of foods to stick to the drum has been partially overcome by a wire-mesh liner that reduces the area of flat metal surface. Longitudinal wood strips around the inside of the drum assure a mixing rather than a sliding action. Slow rotating speed (four revolutions per minute) avoids abrasion.

Fruits and vegetables now being dehydrofrozen commercially include apples, apricots, peas, and pimientos.

Pies made with dehydrofrozen apples are delicious. Bakers have been impressed with the ease of handling this product and with its adaptability to every type of commercial baking procedure. In general, apple varieties that are good for ordinary canning or freezing can also be used for dehydrofreezing.

The flavor of apricot pies made from dehydrofrozen fruit was better in baking tests than that of pies made from frozen, dried, or canned apricots prepared from the same lot of fruit. Appearance, texture, and color compared quite favorably. Preserves prepared from dehydrofrozen apricots were excellent. Fruit texture was firm, and the apricots didn't disintegrate during cooking.

CONTINUOUS ROTARY DRIER used in pilot-plant production of dehydrofrozen fruits and vegetables has a chamber (left) with a perforated sheet-metal drum 10 feet long and 3 feet in diameter. Blowers (right) blast air across steam coils and into chamber at 160°–190° F



Dehydrofrozen pimientos are fine in canned soups, cheese, and meat products. They hold flavor unusually well, and their reduced moisture offers advantages in manufacturing.

Storage tests of dehydrofrozen peas showed them to be just as good as ordinary frozen peas after 1 year of storage at −10° F. Color, flavor, and texture were tops in quality.

In addition to the commodities in commercial production, Royal Anne cherries, freestone peaches, carrots, boysenberries, and diced potatoes have been dehydrofrozen experimentally. Researchers found no significant difference in the color, flavor, and texture of these products and that of food samples commercially frozen from the same lot of material.

Estimates based on these experimental studies indicate that the processing cost in dehydrofreezing is somewhat greater than in freezing. But lower packaging, freezing, storage, and distribution costs should result in an overall saving to users.☆

DEHYDROFROZEN products such as these apple slices not only save on shipping space and weight but also rate high with tasters.

A TEST FOR ANAPLASMOSIS

Ten years of research by USDA, and recently by experimental laboratories of Maryland and several other States, has produced a practical test to identify carriers of the costly cattle disease anaplasmosis. This test is similar to the well-known Wasserman test for human disease.

A way to produce dependable testing material in quantity has just been perfected. This makes it possible to conduct extensive farm-scale experiments looking to the practicability of using the test in a control program for anaplasmosis. In the South and West, where this disease occurs, such experiments may show within a year or two whether it can be controlled or even eradicated in a practical way.

Unchecked in this country for a quarter century, anaplasmosis costs some $10 million annually in mortality and unthriftiness of cattle. Like Texas fever—a serious cattle disease eradicated by USDA some years ago—anaplasmosis is caused by a protozoan parasite that destroys red blood corpuscles. It causes high fever, anemia, weight loss, termination of milk flow, and other serious disturbances—sometimes death.

USDA animal pathologists are working out cooperative plans with livestock sanitation officials in several States to learn something about the number of infected animals in different areas. The researchers also hope to learn more about ways in which anaplasmosis is spread. Some species of ticks and horseflies carry the disease, but we know little else about its transmission under natural conditions.

A large number of herds will be tested on farms and ranges. When the extent of the infection is known, it will still be necessary to conduct extensive field trials to find practical control measures.

Incidentally, anaplasmosis seems to be harmless to man, and the cow is the primary host. Cattle often recover from the disease and live normal lives, but continue as carriers. Meat of cattle infected with anaplasmosis is safe human food.

Diagnosis for anaplasmosis is made by a *complement fixation test.* The test was worked out about 10 years ago by ARS animal pathologists W. M. Mohler, L. O. Mott, and D. W. Gates. It depends on the use of an antigen—extract of the disease parasites from the red blood cells of infected cattle—as a disease detector. Specifically, the antigen shows whether the blood of a suspected animal contains antibodies, those defensive blood substances that the animal creates to combat the parasite. The test is now showing a diagnostic accuracy of about 98 percent when used against known carriers of the disease.

Although the antigen was developed 10 years ago, improvements in the method of producing it were only recently worked out in cooperation with scientists at the University of Maryland. This has now made it possible to set up antigen production for large-scale field trials.☆

CELLS RUN A FERRY SYSTEM

HOW PLANTS GET NUTRIENTS

ROOT CELLS absorb some nutrients from the soil and exclude others. How? That's one of Nature's best-kept secrets. But USDA experiments are lifting the veil a little on this basic plant activity.

Recent discoveries about a sort of ferry traffic in nutrient elements in the plant root cells may give us a better understanding of that basic cell function—nutrient absorption.

Why is this important? To understand plant requirements for soil minerals, man must first understand how plants get them. All life depends on those nutrients—plants depend on the soil, and animals, in turn depend on the plants.

Mineral nutrients in the soil are available as ions. These are electrically charged atoms or groups of atoms of chemical elements, such as sodium and nitrogen.

Sodium nitrate, for example, separates into positively charged sodium ions and negatively charged nitrate ions in the soil solution.

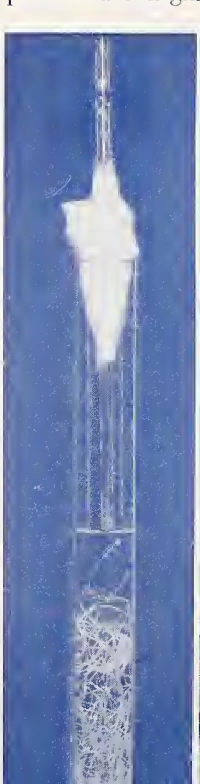
The cell membrane seems to be the key to nutrient absorption—that is, to the rejection as well as the acceptance of nutrients by plants. But what makes ions move? And how do they get through the membrane? Some years ago scientists viewed the membrane as a sort of mesh containing the cell substance and letting in some ions while screening out others. We know better now.

If the membrane were a sieve—which might explain its selectivity—and if ions were self-propelled, one would expect the ions to flow through the membrane, even in the absence of life activity. But when life processes in a plant are stopped—by chilling, poisoning, or lack of oxygen—the plant stops absorbing ions. If those conditions are corrected, the plant will absorb ions again.

So the membranous-screen and ion-self-propulsion theories of nutrient absorption have been discarded in favor of the more recent view that the cell membrane is a medium in which a transportation system of sorts operates—a system with its own reservoir of power. In short, self-powered ferries seem to ply through the membrane, giving free rides to nutrient ions. Or, as expressed by scientists, the cell seems to devote part of its life-giving energy to making and energizing chemical compounds in the membrane. Those compounds probably pick up free ions outside the cell, carry them through the membrane, and deposit them in the cell.

That would explain ion transportation, but what about the cell's selectivity? ARS plant physiologist E. Epstein and his associates have gathered evidence that the ferry compounds are highly specialized as to the kind of ion "passengers" they can carry. He believes that each ferry has specific deck space suited and reserved for a certain class of mineral ions, other deck spaces for the other classes. And all the ions of one group or class compete among themselves for the limited ferry accommodations available to them, but they do not compete with the other classes of ions. Here's the evidence:

Epstein submerged barley roots in ion solutions and checked each ion's absorption. When studying *positive* ions, he supplied these, first singly, then in pairs. The same method was used in studying *negative* ions. In every case, one ion was supplied in radioactive form so it could be measured easily in the plant with a Geiger counter. A second ion, when used, was in nonradioactive form. After a period of absorption, Epstein measured the amount of radioactive ion in the plant roots and learned whether the second or nonradioactive



LIVING BARLEY ROOTS absorbed nutrients from salt solutions in test tubes during ARS nutrient experiments. Roots chose between some nutrient ions as to how much of each to take. But when certain other ions were present, the amount of an ion picked up was determined by competition between the ions themselves. Researcher E. Epstein used an easily traced radioactive ion in each solution. Allowing time for ion absorption, he then removed the roots, burned them to ash, and measured the amount of radioactive ion in the ash (below) with a Geiger counter. Adding a second ion (nonradioactive) of the same positive or negative charge to the solution sometimes reduced the Geiger count, showing reduced uptake due to competition.

›n competed—that is, held down ab-›rption of the radioactive one.

Epstein's experiments reaffirmed ıat ions fall into certain definite ·oups for absorption purposes. Po-ssium, rubidium, and cesium com-rise one group, for example, and ›dium another. There are many ıch groups. When potassium and ıbidium were both supplied to the ırley roots, each was absorbed in ss quantity than when used alone. was clear that these two elements ›mpeted with each other for a lim-ed ferry capacity. But when potas-um and sodium—noncompetitors—ere both supplied, both were ab-›rbed freely and did not compete ith each other. This competition ithin groups and noncompetition etween groups of ions was demon-rated repeatedly with a wide range f chemical elements.

Nearly 20 years ago another 'SDA plant physiologist, Annie urd-Karrer (now retired), treated heat and barley with the poisonous ›ns rubidium and strontium. This ıused a stunting and peculiar thick-ıing of the plant roots. But potas-um added to the rubidium, and cal-ium added to the strontium, pre-ented poisoning.

Hurd-Karrer concluded that plants *ck* "selective discrimination" be-veen certain ions. In other words, ıe amount of one of these ions that plant will absorb depends not on ıe initiative of the plant but on hether a *competitive* ion is present.

In the case of certain other ions, ›wever, Epstein found that plants › *have* selective discrimination. ıch ions are noncompetitive.

These findings suggest that ferti-zers might be used to keep down in-ırious soil substances. At any rate, 's reasonable to assume that the se-ets given up by barley roots grow-g in a few score test tubes will some ıy find their way into commonplace ırtilizing practice.☆

Corn's 35 insect enemies

Most every farmer is familiar with a half-dozen or so insects that make it hard for him to grow any particular crop. Asked to name his worst insect enemies, a corn farmer would quickly tick off earworm, European corn borer, grasshopper, and perhaps a few others.

But USDA entomologist F. F. Dicke, who made a study of pests attacking corn, says that's only a good beginning. He lists 35, including nearly 400 species, of what he terms "the more important corn insects."

Entomologist Dicke believes it is important for a farmer to be aware of all the pests that lower production. Among these 35 insects of corn are enemies that attack every stage of growth and use of the crop. Seed, roots, stalk, leaves, and ears fall prey to one or more insects. · Others carry corn diseases. Still others attack stored corn in bin and elevator, or meal and flour in mill and home.

Take away a few of the foreign insects that have found their way to the United States, and Dicke's list includes about the same names that damaged corn grown in Colonial America. Why, then, the concern?

Early American farmers grew only the corn *they* needed. But today's farmer must grow enough for himself and 14 others. Raising corn is his business—one that depends on efficient production for success.

Today's successful corn farmer still employs many of the early-developed cultural control methods—crop rotation, stalk destruction, timely planting, and proper tillage. He is assisted by beneficial insects deliberately established in this country by entomologists.

During the last decade, he has been getting more spectacular help from organic insecticides and insect-resistant corn hybrids.

Entomologists now can tell a farmer how to use these control methods for a number of corn pests. But first he must know his enemies.

Here is Dicke's list of important corn insects:

Underground feeders: Corn rootworms, cutworms, wireworms, billbugs, sod webworms, white grubs, corn root aphid, seed-corn maggot, sugarcane beetle, grape colapsis, and seed-corn beetles.

Leaf, stalk, and ear feeders: Corn earworm, European corn borer, fall armyworm, southern cornstalk borer, southwestern corn borer, armyworm, lesser cornstalk borer, chinch bug, grasshoppers, corn leaf aphid, corn flea beetle, Japanese beetle, thrips, and leafhoppers.

Stored-grain feeders: Rice weevil, granary weevil, flat grain beetle, saw-toothed grain beetle, cadelle, flour beetles, Angoumois grain moth, Indian-meal moth, pink corn worm, and other stored-grain insects.☆

War with Wind

NEW LESSONS ON THE USE OF SHELTERBELTS AND OTHER BARRIERS

DEFENSIVE WAR AGAINST WIND, fought by farmers on the Great Plains since pioneer days, is entering a new tactical phase. Experiments by scientists of USDA and the Kansas experiment station are providing basic facts on what different kinds of barriers can do to protect crops, livestock, and homes.

Until recent years, any farm barricade against wind was mainly a trial-and-error project. A farmer who considered planting trees for a shelterbelt, building a wood or metal wall, or setting up snow fences, might well wonder: Which barrier would be best? How long and wide should it be? How far would its influence extend?

A "war college" for planning scientific defense against wind is located at Manhattan, Kans. (AGR. RES., Sept. 1954, p. 3). Here, researchers have learned a great deal about barriers by conducting experiments in a wind tunnel. In this tube, a toy-size farmhouse and tiny trees, fences, and fields can be laid out in various ways and subjected to wind-machine attacks ranging from a breeze to a gale. Sawdust snowstorms can be whipped up. Sieved gravel simulates the kind of surface that wind is likely to encounter when it strikes the soil.

Assurance that this quicker, more exactly controlled method of studying wind defense is reliable comes from a comparison of the effectiveness of model snow fences in a wind tunnel versus real snow fences facing real winds. Wind-tunnel data give reasonable estimates of the effects of full-scale barriers under natural conditions if modeli techniques and rules are followed, says N. P. Woodru ARS agricultural engineer.

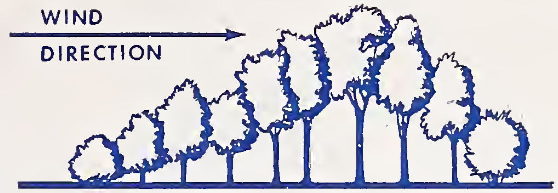
The tunnel tests are yielding basic formulas for deali with wind's speed and force in situations that hara farmers. Wind on the rampage not only carries off t soil but robs soil of moisture, piles snow in drifts, a works havoc with farmhouse heating. Hence, researche seek guiding facts on all these problems.

Success of the defense tactics is shown in statistic columns, such as those reporting the zones of influen provided by different barriers, and effectiveness per t when planted in different barrier designs.

Primary strategy in placing a barrier is to slow do wind and absorb some of its force—just as mountai forests, and other natural obstacles do on the grand sca A manmade barrier affects wind in the same way. diverts currents of air upward, causes a drag on the wi at approximately the same height as the barrier. T lessens the drag on the ground surface, lowers the p vailing surface speed, and creates a pool of relatively ca air within the zone of influence of the obstacle.

From the Kansas experiments come such facts as following, presented for use by soil conservationists, tension agronomists, and other advisers to farmers:

A single snow fence brakes wind velocity consider to distances of 4 to 10 times the height of the fence. F



10-ROW SHELTERBELT, planted so that prevailing winds meet the long slope, is given top rating for general protection. Lowest shrubs would grow to 7.5 feet, tallest trees about 30. The space between the rows is about 10 feet. A five-row belt similarly sloped is nearly as good if land is limited.

WIND TUNNEL tests model house with a 10-row defoliated shelterbelt for winter attack. House is 5 x 5 x 5 inches (1 inch equals 5 feet). Doors have crack space, as in many farm homes. House is warmed to 76° F. by an electrical heating coil, and the recording ammeter (right) measures current needed to maintain this temperature. Alcohol manometer (left) measures the wind velocity.

snow fences spaced at distances 12 times fence height catch about 2.5 times as much snow as one fence, and 4 times as much snow as a single solid wall.

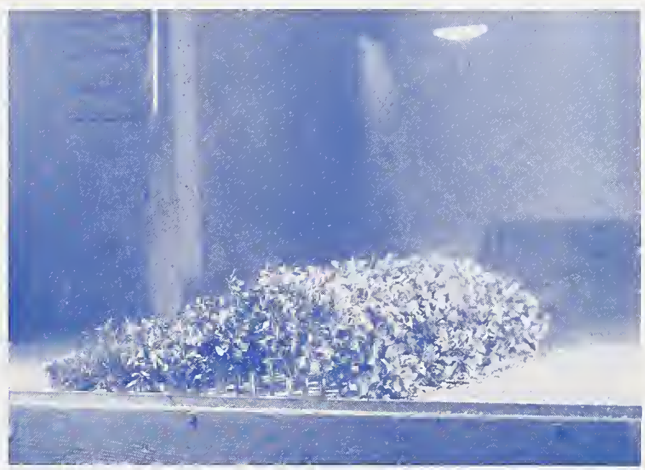
A well-designed shelterbelt of trees and shrubs is likely to catch 3.6 times as much snow as the best arrangement of snow fences.

In leafy season, a 30-foot-high shelterbelt reduces wind velocity 3 feet above ground by one-half for a distance of 14 times the maximum height of the trees. When leaves have fallen, the shelterbelt's effectiveness extends only eight times maximum tree height. Along the ground—where wind erodes soil—the difference is less.

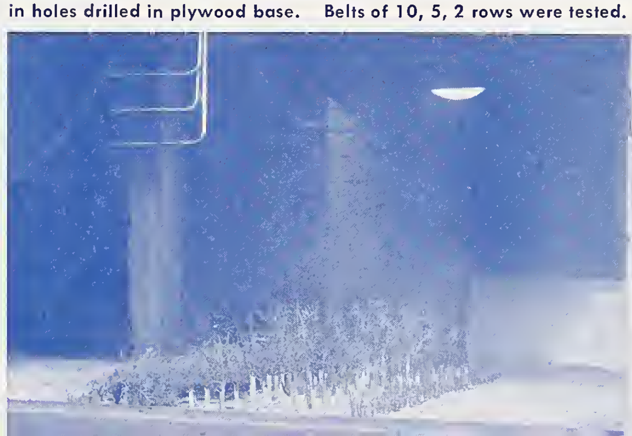
A 10-row shelterbelt near a house can cut fuel use considerably in a windy winter. Percentage saving on heat dwindles the farther the barrier is from the house.

The scientists point out that each type of barrier has its advantages and disadvantages:

Trees planted as a windbreak are perhaps the best type of surface barrier. They are not only more or less permanent and economical but also have an aesthetic value. On the other hand, trees take years to reach maturity and are subject to disease and insect attack. Hence, a farmer often turns to temporary types of barriers, such as snow fences, solid walls, and various tall-growing crops planted in strips. For with these, too, he can reduce wind velocity, control wind-driven snow, and protect small areas of land from loss of top soil.☆



SUMMER AND WINTER versions of 10-row shelterbelt are set for wind-tunnel tests. Spiraea and cedar sprigs, representing shrubs and trees, are held in short lengths of aluminum tubing and planted in holes drilled in plywood base. Belts of 10, 5, 2 rows were tested.



ALL THE DISEASE THEY WANT

Cereal-crop researchers at the USDA Agricultural Research Center, Beltsville, Md., have recently developed incubation chambers for testing rust resistance. These are proving to be big time savers: the ARS scientists now come close to doing a year's work in half that time.

Investigation of rust in wheat, oats, and barley, and of leaf-spotting organisms in rice is conducted in greenhouses. But warm weather comes early in Maryland and stays late. Sun beating through the white-washed glass raises temperatures too high for disease investigation.

But now the inoculated plants are incubated in the new chambers. Conditions in these chambers can be so well controlled that much time once lost to the sun's heat is saved. The scientists make most efficient use of their time and space while the weather is favorable.

Researchers usually follow this procedure in testing for rust resistance: The waxy substance from the plant's cuticle is hand stripped with wet fingers. This helps to hold the spray of water that's released in the chamber at intervals. The plant is then inoculated and put in the chamber for about 48 hours. If the rust race is to be kept pure, the plant is placed in an isolation chamber. After 14 days, it's "read" to determine its resistance. If there's no reason to keep the race pure, plant is placed on a bench until time for a reading.

Both mature and seedling plants are frequently inoculated with the same race of rust since they may be resistant in one stage of their growth and susceptible in another. Then, too, a number of the same variety of plants may be inoculated with different races of rusts.

Forage-crop researchers find the chambers can also be used to test soybeans, clovers, and grasses for resistance to certain leaf spots.☆

INCUBATION CHAMBERS, developed for testing rust resistance, are simply built. Roughly 5 feet high and 30 inches square, they are closed with common window glass and have a layer of moisture-holding vermiculite on their floors. A branched ½-inch water pipe with spray nozzle on each of its two tips automatically releases a spray of water at set intervals when the chamber is in use. The mist clings to the plant.

Strip-plant legumes to renew grasslands

Research has pointed out a good way to rejuvenate seeded grasslands in some low-rainfall areas of the West: strip planting with legumes.

This comes from scientists of the State experiment station, Agricultural Research Service, and Soil Conservation Service at Cheyenne, Wyo., where average rainfall is about 15 inches. Plowing and seeding alfalfa in 42-inch strips between strips of sod 6 to 8 inches wide boosted forage yield 83 percent.

Other methods of mechanical renovation—disking, ripping the sod with spike-toothed implements to depths of 5 and 8 inches, and moldboard plowing without seeding—were tried by USDA soil scientists F. Rause and O. K. Barnes and Wyoming agronomist R. L. Lang. These methods were compared in 1950, 1951, and 1952 in pastures that had been seeded in 1941 to crested wheatgrass, western wheatgrass, or Russian wildrye.

Only the ripping of the sod to a depth of 5 inches failed to give some increase in forage production.

The average untreated check yielded 612 pounds of annually harvested forage. Comparable production from disking was 712 pounds; ripping to a depth of 5 inches, 607; ripping to 8 inches, 709; and plowing rows, 805. Row-plowing and seeding alfalfa sent annual average production up to 1,119 pounds. When sweetclover was seeded, production was 779 pounds. And a sweetclover-alfalfa combination yielded 994 pounds.

Each of the treatments helped renovate crested wheatgrass and Russian wildrye pastures, but seeding alfalfa did the most good for both. With western wheatgrass, ripping the sod to depths of 5 and 8 inches, and seeding sweetclover all caused drops in forage productivity.☆

FRUITS and VEGETABLES

Strawberries get a break

RESEARCHERS STOP NEMATODES

A NEW CONTROL for nematodes in strawberries may help revive this declining industry. It's USDA's second important maneuver of recent years against top strawberry pests.

Hope for stopping nematodes rests on a hot-water plant treatment. This procedure, which has proved highly effective, should be in wide use by nurserymen within a year.

The earlier innovation—foundation stocks of virus-free strawberry plants—began reaching growers last spring (AGR. RES., July 1953, p. 11). ARS started the research leading to these plants in 1951, and sent the first plants to nurserymen in 1952.

Nematodes and viruses are found in almost all cultivated strawberries and probably have been around since the start of strawberry culture. They sap plant vigor, retard nutrient absorption and metabolism, and reduce size, yield, and quality of fruit.

The advantage of freedom from nematodes and viruses has been demonstrated in a few experimental fields. The plantings produced much higher yields, better quality, and a higher percentage of large berries. That improves value and lowers cost. Large berries can be picked faster, and picking is an important cost item.

Several kinds of the microscopic nematodes (sometimes called eelworms) attack strawberries. They're chiefly the root-knot, meadow or root-lesion, sting, stem, and two or more bud-and-leaf species. They work on roots, buds, crowns, stems, flowers, runners, and runner plants.

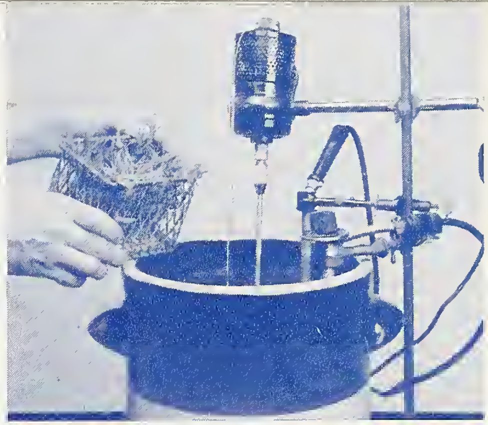
Nematode eradication was undertaken about 2 years ago as a second stage of the project to clean up foundation stocks of plants. The original plan was to eliminate nematodes by rooting nematode-free plant runners in pots of sterile soil under rigid sanitation procedures.

Nematodes were to be kept out of those plants—were kept out, in fact, until the pest unaccountably appeared in a few plants early last winter. That mischance cast suspicion on the entire lot and caused pathologists A. C. Goheen and J. R. McGrew to turn to other methods.

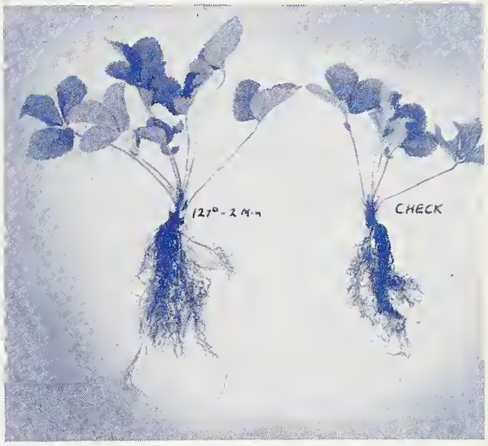
Plant treatment with hot water had been tried on strawberries by several researchers without full success. Either the treatment failed to kill the nematodes, or it weakened or killed the plants. By patient experimentation, Goheen and McGrew worked out a satisfactory combination of temperature and timing that is effective, safe, and easy to use.

This winter, nurserymen can treat their planting stock that's already free of virus. They should be able to supply growers with virus-free, nematode-free strawberries of a satisfactory variety by 1956. Some stocks of these plants—that is, strawberries free of viruses and *relatively free of nematodes*—will be available this winter in a number of varieties.

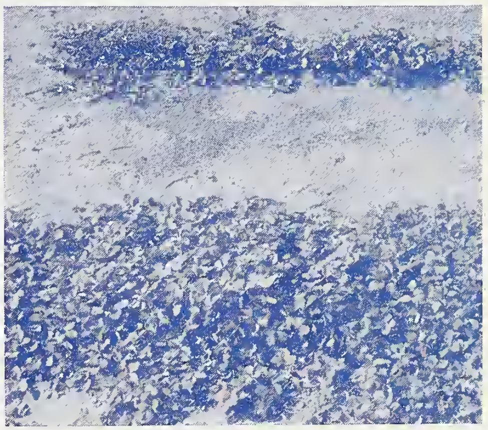
Advance soil fumigation, pest-free plantings, and rigorous aphid control should give relative freedom from viruses and nematodes (possibly except for some Pacific coast areas). That would mean better crops and longer life to the planting, for viruses and nematodes are main causes of plant weakness and degeneration.☆



EXPERIMENTAL equipment gave plants hot baths at a variety of temperatures and times. Some plants were then dried and put in cold storage, others planted in nursery.



IMMERSION at a temperature of 127° F. for 2 minutes resulted in strongest plants. Those stored 30 days after treatment were stronger than plants set out immediately.



TEST FIELD shows the effects of nematodes. Pest-free plants were set, but soil in foreground was fumigated, killing nematodes. Untreated soil at rear is infected.

Beating the blackfly

PARASITES KEEP IT DOWN

MILLIONS of tiny, wasplike enemies of the citrus blackfly are easing the threat of this pest to United States citrus growers.

USDA entomologist T. R. Gardner, back from a 2.000-mile tour through infested parts of Mexico, reports that the parasite insects are controlling blackflies over wide areas.

The inspection party, which included ARS, California, and Mexican scientists and officials, traveled down the east coast of Mexico through the State of Tamaulipas, across the country west of Mexico City, and north along the west coast.

Only in northwestern Mexico have the Asiatic parasites been slow to take hold. So it's here that cooperating scientists of Mexico and the United States are now concentrating their efforts to gain parasitic control of the injurious blackfly.

A particular pest of citrus, the blackfly feeds on the leaves of oranges, lemons, limes, and grapefruit to make the trees totally unproductive. To a lesser extent, it attacks pear, quince, plum, avocado, ash, poplar, pomegranate, and grapes.

Since 1935, when the citrus blackfly was discovered in Eldorado, Mexico, it has moved rapidly north and east toward our own country. Last year, it was found at Matamoros, across the Rio Grande from Brownsville, Tex. This spring, it appeared on the Mexican side of the border near Laredo. An intensive spray program aimed at eradicating this isolated infestation was promptly carried out by Mexican-United States control teams.

Our entomologists work with the Mexican Government to slow blackfly spread throughout Mexico and to suppress heavy infestations. This program not only has enabled many Mexicans to grow fruit despite the blackfly but also has protected American growers from a sudden invasion.

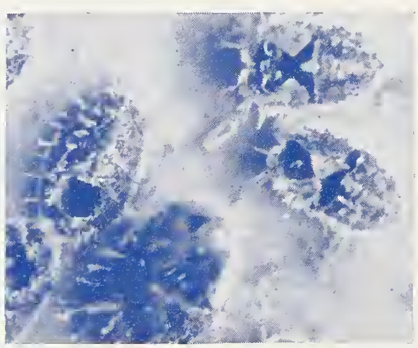
For 7 years, research-developed sprays have stemmed this insect's march toward the United States. Since 1950, parasites have given the blackfly a jolting setback.

ARS entomologists found these waspish parasites in India and Pakistan. Four different species effective in those countries were introduced into Mexico in 1949 and 1950. All have proved successful (see pictures). Some species have prospered so well that researchers have been able to collect millions of them in Mexican groves for release in other infested areas. Occasionally, two species team up against the blackflies: one quickly reduces a heavy infestation, then the second takes over and holds the infestation to a low level.

Blackfly control with parasites isn't new. Concern over the threat to Florida from a blackfly infestation in Cuba sent American entomologists to Malaya in the late 1920's to search for parasites. In 3 years—from 1929 to 1931—a single species of Malayan parasite knocked out the threat and has given good blackfly control in Cuba ever since.

This parasite has done equally good work in Jamaica, Haiti, the Bahamas, Canal Zone, and Costa Rica. It was established in Mexico about 10 years ago, but differences in climate apparently kept it from effecting control as it did in Cuba.

Our blackfly defense is now three-deep: First, quarantine guards intercept many larvae and pupae that would otherwise be brought into this country on leaves and plants. Second, several parasites have been established. And, third, the ARS Mexico City Fruit Insect Laboratory has developed effective insecticidal methods that will control or even eradicate the pest in limited areas.☆

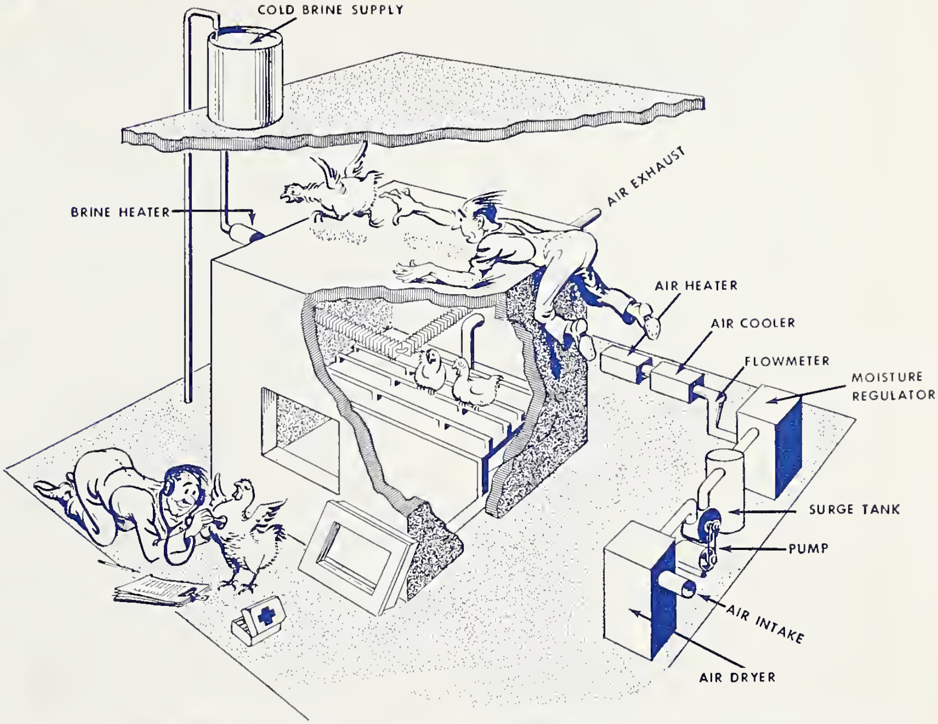


BLACKFLIES emerged normally from pupal cases at right, but cases at left have been parasitized by one of four species of wasplike insects from Asia. Parasites lay their eggs in bodies of blackfly larvae or pupae. Eggs hatch into maggots, devour their host.

PARASITES have done so well in Mexico that collectors can capture plenty of adults to release in other infested areas. Insects jump up into tube, which holds about 100. An average of 25 adult parasites—sometimes up to 50—may be found on one orange leaf.

Environment— as chickens like it

HOW TEMPERATURE AFFECTS BABY CHICKS AND LAYERS



BIG CALORIMETER can be set up to simulate farm conditions for layers or broilers, but gives researchers close control over environmental temperature, humidity, airflow, and light.

WHAT'S THE BEST brooding temperature for baby chicks? And what temperature gets the best performance out of laying hens? USDA scientists have just made some interesting findings on both questions.

Results of poultry environmental studies at the Agriculture Research Center, Beltsville, Md., show that—

1. A relatively high brooding temperature of 86° F. gets chicks off to a fast start. But after 5 weeks, chicks brooded all the way at 67° gain weight more rapidly.

2. Kept under constant-temperature conditions, hens lay the most eggs with the least feed per egg at 55° F. The studies showed, however, that egg production was only 5 to 10 percent lower at other constant test temperatures from 40° to 75°.

These results mark the beginning of what cooperating ARS agricultural engineers and poultry husbandmen believe will be an important accumulation of fundamental information. It will help the engineers develop better structures and equipment. And the poultrymen will gain new knowledge of how environment affects the physiology and nutrition of chickens.

The studies are carried on in two oversized calorimeters (see drawing). These 5- by 7-foot boxes help scientists observe how different temperatures, humidities, and air speeds affect chickens. In some instances, the effects are measured in terms of heat and moisture given off in eggs, respiration, and droppings.

Agricultural engineers Hajime Ota and H. L. Garver designed and built the calorimeters and are now operating them. Poultry scientists working with the calorimeters include E. H. McNally, R. J. Lillie, J. R. Sizemore, W. E. Shaklee, M. H. Conner, and W. Wilson (on sabbatical leave from University of California).

In the brooding tests, 70 1-day-old New Hampshire chicks were placed in each calorimeter. One—the "hot box"—was maintained at 86°, the other—the "cold box"—at 67°. As the test progressed and the birds grew, the number of chicks in each calorimeter was cut to 35 to prevent crowding. The temperature under the hover of each calorimeter was 95° at the beginning of the test; this was lowered 5° each week until the calorimeter's constant temperature level was reached. Relative humidity in both cabinets was near 75 percent.

Chicks in the hot box were very active and ate normally—unlike the obviously chilled cold-box chicks, which spent much of their time under the hover. Then, chicks in the cold box

began to narrow the weight difference. On the 38th day of the test, they matched the hot-box chicks in average weight. And during the remainder of the test period, until they were 13 weeks of age, they continued to grow away from the hot-box birds. During the last 5 weeks, birds in the hot box were panting.

At the end, male birds brooded at 67° averaged 3.36 pounds (New York-dressed weight), males brooded at 86°, 2.94 pounds. Females from the cold box averaged 2.66 pounds, those from the hot box, 2.48 pounds.

Researchers observed that birds reared in the cold calorimeter feathered first. Those in the hot box developed sexually more rapidly. Hot-box roosters crowed at 7 and 8 weeks. Post-mortem examination revealed that the stress of colder environment had significantly enlarged the hearts and thyroid and adrenal glands of the chicks brooded at 67°.

The constant-temperature laying tests, which established 55° as the optimum for efficient egg production, were carried out with Rhode Island Red hens. Relative humidity ran about 75 percent in the chambers.

Of course, most poultrymen probably would find it unprofitable to maintain laying-house temperatures at 55°. Only severe temperatures—below 40° and above 70°—caused marked drops in egg-production efficiency. At 23°, the lowest temperature tested, production averaged 26 percent. At 85°, the highest temperature, production ran 50 percent. Production hit 75 percent at 55°.

Temperature effect measured in feed consumption showed hens at 23° eating 12.3 pounds of feed for every pound of egg laid; at 85°, 4 pounds of feed; and at 55°, 3.5 pounds.

The scientists are improving their equipment and techniques as these studies move ahead. The findings may take on increasing importance for egg and broiler producers.☆

All-out on Brucellosis

USDA AND COOPERATING STATES are planning an all-out effort to wipe out brucellosis, a disease that cost cattlemen an estimated $58 million last year. It's also a human health problem as undulant fever.

This disease in cattle, otherwise known as contagious abortion or Bang's disease, reduces milk flow about 20 percent, and the calf crop of infected animals, through abortion, about 40 percent. One cow out of 9 tested at the start of eradication work 20 years ago had brucellosis. Today, only 1 out of 39 has it. Moreover, the disease has been reduced to less than 1 percent in the cattle population in 3 States—North Carolina, New Hampshire, and Maine—and in many counties elsewhere. So the goal of eradication is closer today than ever before.

ARS has about $14 million available this year and will have $19 million next year for this program, compared with about $4 million annually for some years past. In addition, about $10 million is provided by the States for the cooperative program to combat brucellosis.

Main features of the eradication program are testing to locate the disease, slaugher of diseased animals, and vaccination. There are two ways of locating the disease in a herd. A so-called ring test of a pooled sample of a dairy herd's milk or cream will show whether any infected animals are contributing milk to the pooled sample. If infection is found or if the ring test is not used, each animal in the herd except calves and steers must be blood tested to locate individual reactors.

Under programs developed and administered cooperatively with the States, control officials make agreements with individual producers under one of the approved plans. Testing is without expense to the owner, and in most States an indemnity is paid for slaughtering diseased animals within 15 days following appraisal. Federal indemnity can't exceed one-third of the loss incurred by the cattleman. Nor can it exceed $25 for a grade animal or $50 for a purebred slaughtered.

There are four plans for brucellosis eradication. Most effective and widely used are Plans A and B. Plan A requires that diseased cattle be permanently marked and removed from the premises for immediate slaughter. In addition, vaccination of calves is optional. But Plan B requires vaccinating of all calves with Strain 19 (a vaccine developed by the Department), in addition to testing and quarantining on the premises any animals that react to the test. Reacting animals must be slaughtered within 3 years. This plan makes possible the raising of disease-resistant heifer replacements before slaughtering reactors.

The other two eradication plans rely on vaccination. Plan C (see AGR. RES., Mar.–Apr. 1953) requires vaccination of all calves, with the idea of ultimately developing a disease-resistant herd. When tests show that the disease is spreading rapidly in a herd, the owner may, with written permission of control officials, vaccinate all adult nonreactors as well as calves. That's Plan D, purely an emergency measure to stop the spread of brucellosis.☆

NEW FARM POWER PROSPECT

An experimental, electricity-generating tractor that can supply power almost anywhere, any time, is now undergoing tests at the USDA Agricultural Research Center, Beltsville, Md. It's the Electrall, developed by International Harvester Co. and General Electric as their answer to hundreds of farm and ranch power problems.

Designers of the Electrall say it can furnish normal or emergency power for nearly every electric motor that's used on a farm.

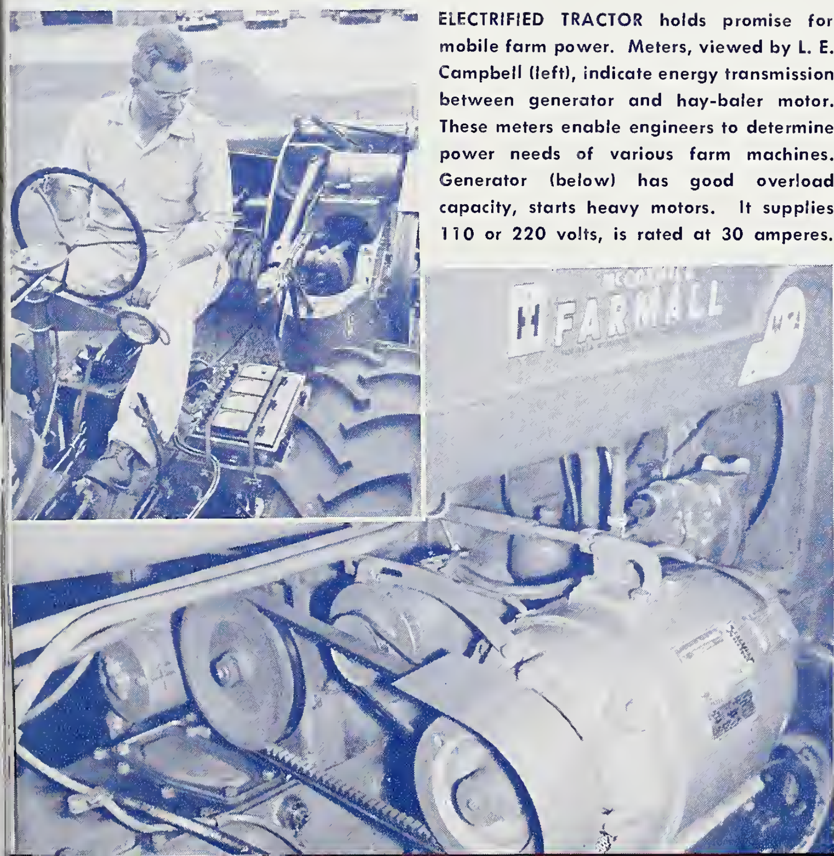
They envision a farmer using his generator-fitted tractor to keep lights burning and milk coolers operating when high-line power is stormed out . . . supply power to farm machinery equipped with electric motors (substituting for heavy gasoline engines a portable electric motor that could readily be shifted from combine to baler to forage harvester would lower equipment and maintenance costs) . . . . do many important odd jobs beyond the reach of farm electric service—from powering a chain saw at the woodlot to energizing a welder for machinery repair in the field.

ARS engineers, first public researchers to receive an Electrall, plan to test its potential in weed, insect, and nematode control.

Electric weed control (drawing an electrically charged bar over weeds to kill them) is already being offered as a custom service in some areas. Will an electricity-generating tractor make this a practical operation?

Having a mobile source of power will allow the engineers to extend to the field their experiments with electric energy for insect control.

They will also try to develop equipment that can be used with the Electrall for effectively electrocuting soil-infesting nematodes, which are proving difficult to control with other available methods.☆



ELECTRIFIED TRACTOR holds promise for mobile farm power. Meters, viewed by L. E. Campbell (left), indicate energy transmission between generator and hay-baler motor. These meters enable engineers to determine power needs of various farm machines. Generator (below) has good overload capacity, starts heavy motors. It supplies 110 or 220 volts, is rated at 30 amperes.

Readers' REACTIONS

At home:

Sir: When I saw the the plans of the "Experimental Farm House" [Oct. 1954, p. 10], it occurred to me that this story would make a nice feature for our magazine, provided, of course, the house design would suit the rugged climate of Minnesota and the two Dakotas. Would it? If not, what modifications in insulation and other construction details would make it suitable?—W. H. Kircher, Managing Editor, The Farmer, St. Paul.

● The design is suitable for that region. Walls should be furred and insulated for such a severe climate, the foundation should be below frostline, and a furnace with sufficient heating capacity should be chosen. Our engineer furnished Mr. Kircher details for his region.—Ed.

Uncharted:

Sir: The short but admirable article "How Much Fertilizer?" [Sept. 1954, p. 7] touches on a point which has been of real interest—i. e., the development of a simple chart showing the varying degrees of profitable fertilizing rates for various crops including the adaptation of fertilizer grades and quantities consistent with the farmer's available capital.

Mention is made of the suggestion that such a chart be put up in simple, understandable form. Has this been done—or was the suggestion that it be done by others? I am particularly interested in the Middle West and the southern part of the Corn Belt.—Elmer H. Doe, Doe-Anderson Advertising Agency, Louisville, Ky.

● So far, no one has attempted to make such charts available to farmers. Examples of how these charts could be drawn up will appear in a publication on profitable use of fertilizer in the Midwest, to be issued by the Wisconsin Agricultural Experiment Station, Madison.—Ed.

Approval:

Sir: This is an excellent publication. I hope it continues to be so instructive, conservative, and reliable.—E. V. McCollum, emeritus professor of biochemistry, Johns Hopkins University, Baltimore.

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AGRISEARCH Notes

APPOINTED: research deputy

Administrator B. T. Shaw recently named George W. Irving, Jr., to the post of ARS Deputy Administrator for Research. This completes the top staff of ARS (see Agr. Res., Dec. 1953, p. 2; Feb. 1954, p. 3).

Other appointments since our first list include C. D. Van Houweling, Director, Livestock Regulatory Programs; W. D. Maclay, Chief, Northern Utilization Research Branch; S. B. Fracker, Assistant to Administrator (International Program and Interdepartmental Relations); B. D. Joy, Assistant to Administrator (Executive Secretary of Agricultural Research Policy Committee, Commodity and Functional Advisory Committees); C. E. Schoenhals, Assistant to Administrator; S. P. Williams, Director, Administrative Services Division; E. G. Moore, Director, Information Division.

Now, with the reorganization a year old, the new alinement of research and regulatory jobs seems to be working smoothly and effectively.☆

REGULATED: pesticide chemicals

The Miller pesticide residue amendment (Public Law 518), passed by the 83d Congress in July, gives new responsibilities with respect to regulating the amount of pesticide chemicals that can safely be left in or on foods in their raw or natural state.

This law amends the Federal, Food, Drug, and Cosmetic Act, which the Food and Drug Administration of the Department of Health, Education, and Welfare enforces. To protect the public health, Public Law 518 requires the DHEW, within definite time limits, to establish tolerances with respect to the residues, in or on raw agricultural commodities, of poisonous or deleterious pesticide chemicals, or to exempt them from requirement of such a tolerance.

USDA has two legal functions in enforcing this law. (The Department has previously consulted informally with FDA in determining safe use of insecticides and in registering such materials for shipment in interstate commerce.) Through the Pesticide Regulation Section of its ARS Plant Pest Control Branch, USDA will determine for FDA—usually within 30 to 60 days after request from a registrant of an economic poison—whether or not a pesticide chemical is useful for the purpose for which a tolerance or exemption is sought. It also will give FDA its opinion with regard to the residue likely to result from the proposed use of the chemical.

Regulations for USDA's part in enforcing the new law were in preparation as Agricultural Research went to press and will probably be in force early this month.☆

IMPROVED: apple sauce

A tangy, fresh-flavored apple sauce is the latest food product resulting from use of fruit essences recovered by a process developed by the USDA Eastern Regional Research Laboratory (Agr. Res., Aug. 1953, p. 11).

ARS scientists, working cooperatively with Knouse Foods Co-operative, Inc., have now added to apple sauce an essence made from the byproduct peels and cores. A trained taste panel and many consumer tasters showed a decided preference for the essence-fortified sauce.

Both trained and consumer tasters liked the slight extra tartness produced by adding 0.1 percent citric acid to the essence-fortified sample. The same sauce with added essence and acid was still rated significantly better than the unfortified sauce after 9 months' storage.

Commercialization of this sauce depends on development of a method for adding essence in processing, plus acceptance of a slightly higher priced product.☆

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